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Conference Abstract

Ultrananocrystalline diamond coated implants for enhanced osseointegration

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Abstract

Osteoporosis causes bones to become weak and brittle. It is known that the alterations in bone metabolism associated to osteoporosis can impair bone healing around implants and affect their osseointegration. The main objective of this study was the development of new nanostructured implant materials based on ultrananocrystalline diamond (UNCD) coatings for enhancing osseointegration. The films were deposited on Ti substrates by microwave plasma CVD from 17% CH_4/N_2 gas mixtures and modified by O_2 or NH_3/N_2 plasmas. The modifications rendered the H-terminated hydrophobic as-grown films hydrophilic. The interaction of endothelial (EA.hy926) and osteosarcoma (MG63) cells with differently modified UNCD surfaces was investigated by proteome analyses. It revealed the identification of over 19 000 proteins (extracellular and cytosolic). They correspond to 508 (Ti), 634 (UNCD), 651 (O-UNCD), and 668 (NH_2-UNCD) protein groups. The interaction network analysis showed differences in the connectivity of inferred protein networks between the ECM niches, which suggests the presence of specific cell microenvironments on O- and NH_2-terminated UNCD surfaces. Our results show that due to a favorable combination of surface chemical and topological properties the UNCD films, as-grown and especially after their plasma modifications, may serve as superior scaffolding for promoting the cell attachment and growth during osseointegration.

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Keywords

Ultrananocrystalline diamond films, Surface modification, Titanium, Implant materials Osseointegration, Proteomics

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Conflicts of interest

The authors declare that there is no conflict of interests.